

SPECIFICATION

TITLE: QUALITY REQUIREMENTS FOR SUPPLIERS AND SUBCONTRACTORS FOR  
THE SHUTTLE PROGRAM, GENERAL SPECIFICATIONS FOR

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1.	See Amendments C01	3/7/74	GO 40039
2.	See Amendment C02, direct specification changes incorporated and released at "C" revision	1/28/75	GO 40039

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1. SCOPE

This specification defines the basic requirements for Seller's quality assurance activity in support of Buyer's commitment to the National Aeronautics and Space Administration (NASA) for the Space Shuttle Program.

2. APPLICABLE DOCUMENTS

None

3. REQUIREMENTS

3.1 Management and Planning. Seller shall maintain an effective quality assurance activity, planned, and developed in conjunction with all other Seller functions necessary to satisfy the requirements of Buyer's procurement order in a timely manner.

3.1.1 Management Delegation. Seller shall designate one individual who shall have the responsibility and authority for directing and managing the quality activity. The designated individual shall have direct unimpeded access to the management level having full responsibility for the contract work, and shall report regularly to higher management on the status and adequacy of the quality activity.

3.1.2 Quality Assurance Plan. Seller, if specified in Buyer's data requirements document, shall prepare, maintain, and implement a quality assurance plan which describes how Seller will ensure compliance with the applicable requirements of this specification.

3.1.3 Quality Controls. Seller shall tailor quality requirements for Seller and suppliers with consideration of the state of hardware development, Seller experience, hardware unit cost, and hardware use, and shall identify how quality tasks will be implemented with both Seller and supplier hardware.

3.1.3.1 Policies and Procedures. Seller shall use existing policies and procedures to the maximum extent possible, and shall develop new procedures only for requirements unique to the Space Shuttle Program. These policies and procedures shall be available for Buyer review.

3.1.3.2 Nondestructive Evaluation. Seller shall integrate the definition, assessment, validation, and application, including sequence of operation, of nondestructive evaluation (NDE) methods, to meet design, development, production, and test requirements of the Shuttle program. For critical components and structures, quantitative accept/reject criteria shall be established where possible to enable selection of validated NDE methods capable of detecting incipient flaws and variations in material properties. Seller shall seek alternate design or fabrication techniques when known NDE methods are inadequate, or shall undertake development of improved NDE methods, with Buyer approval, as appropriate.

3.1.3.3 Training and Certification. Seller, prior to performing work specified in Buyer's purchase order, shall train and shall certify as competent those personnel in Seller's manufacturing and inspection functions who have job assignments which require a demonstrated level of knowledge and skill. Special processing and nondestructive testing typify the operations for which Seller shall maintain documented training and certification programs. The certification programs shall include provisions for periodic recertification of personnel including demonstration of proficiencies where appropriate.

3.1.3.4 Effectiveness and Objectivity. Seller shall ensure that the effectiveness of quality functions and the ability of assigned personnel to objectively assess, document, and report findings is not reduced by other considerations (such as the influence of engineering changes, rework, or rescheduling) during all phases of the contract work.

3.1.4 Quality Program Audits.

3.1.4.1 Seller Responsibility. Seller shall conduct random unscheduled audits of personnel, procedures, and operations which implement the quality program. Each audit shall include examination of operations and documentation, evaluation of actual operations as compared with established requirements, recommendations for remedial and preventive action, and follow-up to assess results of recommendations and shall include examination of articles and materials to verify the effectiveness of Seller's efforts. The results in each area shall be documented.

3.1.4.2 Buyer Prerogatives. Seller shall permit Buyer to conduct quality audits as required to evaluate Seller's compliance with applicable portions of this specification. Seller shall make available to Buyer at Seller's facility a copy of each specification, instruction, procedure, record, or special requirement deemed by Buyer to be necessary and pertinent to the conduct of such quality audits.

3.1.5 Management Assessment Data. Seller shall present the quality status by periodic meetings with Buyer. The meetings should cover significant accomplishments, potential management and hardware problems, recommendations, summary of remedial and preventive \_\_\_\_\_, quality costs, data on scrap rates, repair frequency and end-item discrepancies, including data from suppliers providing critical hardware, as applicable.

3.2 Design and Development Controls.

3.2.1 Technical Documents.

3.2.1.1 Quality Requirements. Seller shall ensure inclusion of quality characteristics and design criteria necessary for procurement, fabrication (including assembly), and inspection and test operations, as applicable in specifications, procedures, drawings, and fabrication and planning documents.

3.2.1.2 Document Review. Seller quality assurance personnel shall conduct timely reviews of technical documents that affect quality, and of changes to such documents.

3.2.2 Quality Support to Design Reviews. Seller's quality activity shall include participation in design reviews to ensure that designs permit and facilities producibility, repeatability, inspectability, and maintainability and that related quality considerations are well defined.

3.2.2.1 Acceptance Reviews. Seller shall ensure that the following are accomplished in support of the acceptance reviews required by the procurement order:

- a. Evaluation of hardware checkout and test operations and results with discussion of anomalies encountered, failure history, and remedial and preventive actions; status of all open tests with an identification of those that constrain further activities, such as flight mission.
- b. Identification of waivers and deviations to procurement, process and material specifications and verification basis for approval.

- c. Status of limited-life components and their remaining life.
- d. Identification of shortages, open work items, and related corrective actions.
- e. Status of open work items (to be accomplished).
- f. Verification that departures from specifications and drawing requirements have been processed in accordance with paragraph 3.7.
- g. Verification that all data packages and support manuals for the operation, checkout, and maintenance of Seller's end-item are complete, compatible, and accompanying the hardware, and that all shipping requirements of this document have been met.

### 3.2.3 Change Control.

3.2.3.1 Change Affecting Quality Activity. Seller shall be responsible for control of documents generated by the quality activity, and for control of changes to such documents, including review of engineering changes to determine quality impact.

3.2.3.2. Change Coordination. Seller shall coordinate Seller and supplier quality activities to ensure proper and timely assessment of any quality impact generated by engineering changes.

3.2.3.3 Change Effectivity. Seller shall verify that the effectivity points of documents and changes which affect materials, fabrication, or quality are clearly identified. Provisions shall be made for inspection and test of changed articles or materials.

### 3.3 Identification and Data Retrieval.

3.3.1 General. Seller shall develop and maintain a documented system of identification control and data retrieval for articles and materials to provide positive correlation with procurement, fabrication, processing, inspection, test, and operating records, and to provide means for locating articles and materials. Seller's identification and retrieval system shall be developed in conjunction with other Seller management systems, such as engineering documentation control, configuration management and logistics management. Identification numbers and procedures shall be common to all systems.

3.3.2 Identification and Data Retrieval Requirements. When required by the procurement specification, articles shall have, as a minimum, detailed identification to their origin, i.e., manufacturer; materials (on a selected basis); manufacturing date; date purchased; lot, inspection, or test data; or other pertinent information. Consideration shall be given to limited-life articles and materials, electronic, electrical and electromechanical parts or articles and materials with special processes for which identification and data retrieval are useful in controlling process changes and recall in the event defective parts were manufactured under the process.

Equipment with identification and data retrieval requirements shall automatically require identification and data retrieval through all higher levels of assembly.

3.3.3 Identification Methods. Each article and material shall be identified by a unique part or type number when control of articles or lots is required, utilizing date codes, lot numbers, serial numbers, or combinations thereof, as appropriate; deviations from this method must be approved by Buyer.

3.3.4 \_\_\_\_\_ . The location of part or type numbers and detailed \_\_\_\_\_ articles and materials and methods of application, \_\_\_\_\_ indicated in technical documents.

3.3.5 Identification Control.

- a. Controls shall be established to ensure that detailed identification numbers for individual articles and materials or lots thereof are assigned by a consecutive manner.
- b. Records for articles and materials shall indicate applicable part or type numbers and associated detailed identification. This shall provide the capability of tracing backward to the material from which fabrication originated and to determine the location of the like article or materials within a level of process or assembly.
- c. Serial or lot numbers of scrapped articles or materials shall not be used for other similar articles or materials.
- d. Temporarily installed items shall be clearly identified to permit easy location and removal after use.

3.3.6 Record Retrieval. Seller's identification system shall ensure that article and material procurement, fabrication, processing, inspection, and test records are related to the applicable articles and materials.

3.3.7 Retention of Records. Records of articles and materials which have been designated for identification and data retrieval shall be retained in a safe, accessible location by Seller for the period specified in Buyer's procurement order, unless released prior to that time by contractual authorization. Seller shall invoke this requirement on Seller's suppliers.

3.4 Procurement.

3.4.1 Procurement Controls. Seller shall assure the adequacy and quality of all Seller-purchased articles, materials, and services. Seller shall plan, implement, and maintain procurement quality activity to ensure timely and adequate integration with all other elements to Seller's organization (design, procurement, etc.) having responsibility for control and performance of suppliers. Seller's procurement quality activity shall participate in supplier selection, development of quality requirements, review of procurement documents, technical assistance to suppliers, approval of supplier quality and inspection systems, assignment of quality representatives, and evaluation of supplier quality performance.

3.4.2 Selection of Seller's Procurement Sources. Seller quality personnel shall participate in the selection of Seller's suppliers. Seller's selection shall be based on an evaluation of suppliers' quality history, the results of a quality system capability survey, or Seller's ability to inspect procured articles and materials after receipt from suppliers.

3.4.3 Procurement Documents.

3.4.3.1 Review. Procurement documents that are issued at Seller plant sites and facilities, including other divisions or subsidiaries of Seller's organization, shall be reviewed by quality personnel for adequacy of quality requirements prior to release.

3.4.3.2 Contents. Seller shall tailor each procurement order to include only the necessary quality assurance requirements, as determined through consideration of the state of hardware development, Seller experience, hardware unit cost, and the use of the part, component, subsystem, or system.

Seller shall invoke this specification, or applicable portions thereof, in procurement subcontracts for systems, subsystems, selected components, and related services. Seller's existing procurement requirements document(s) may be used for this purpose when applicable requirements of this specification are included.

Seller's procurement documents shall contain provisions for the following:

a. Government Source Inspection (GSI): When the NASA elects to perform inspection at a supplier's facility, the following statement shall be included in the procurement document:

"All work on this order is subject to inspection and test by the Government at any time and place. The Government quality representative who has been delegated NASA Quality Assurance functions on this procurement shall be notified immediately upon receipt of this order. The Government representative shall also be notified forty-eight (48) hours in advance of the time articles or materials are ready for inspection or test."

b. Procurements Other Than Those Requiring Buyer Source Inspection or GSI: Procurements which do not require Buyer or Government Source Inspection shall include the following statement:

"The Rockwell International Corporation or the Government has the right to inspect any or all of the work included in this order at the supplier's plant."

c. Supplier Data Package: Seller shall specify the total data package requirements for the supplied article, including equipment record and historical data requirements.

d. Pressure Vessel Historical Data Requirements: Seller shall maintain historical data on each pressure vessel in accordance with Buyer's instructions.

e. Cleanliness Control: Seller shall specify detailed cleanliness controls as applicable.

f. Ordnance Data Requirements: Seller shall maintain data on each pyrotechnic device in accordance with Buyer's instructions. The data shall be maintained and compiled for inclusion into the acceptance data package and to support lot certification.

3.4.4 Seller Quality Assurance Personnel at Source. Seller may assign resident or itinerant quality assurance personnel at supplier facilities.

3.4.5 Government Source Inspection.

a. Source inspection performed by and for the convenience of the Government (NASA) on procured articles or materials shall not relieve Seller of Seller's responsibilities for ensuring product quality.

b. Seller shall submit procurement documents to the designated Government quality representative for determination of the need for Government Source Inspection.

- 3.4.6 Receiving Inspection. Seller shall maintain a documented receiving inspection system which ensures, as applicable:
- a. That procured articles and materials indicate evidence of inspections and tests performed by the supplier in accordance with purchase requirements and are accompanied with required inspection and test data.
  - b. As a minimum, receiving inspection and test shall include verification of characteristics and design criteria which have not been source inspected by Seller and which can be verified without disassembly of the article. Particular emphasis shall be placed on those characteristics for which nonconformances may not be detected during subsequent inspections and tests.
  - c. The receiving inspection system shall also ensure, when required, that the articles and materials exhibit evidence of initiation of useful life, the life or cycles used, and the date and test time or cycle at which useful life will be expended.
  - d. That supplier certification of compliance with specified requirements is verified through periodic chemical analysis and physical testing of randomly-selected portions of materials received.
  - e. That the inspection status of articles and materials is maintained during receiving inspection and test operations. This shall include physical separation and identification of articles and materials according to the following categories:
    - (1) Items awaiting inspection or test results.
    - (2) Conforming items.
    - (3) Nonconforming items.
  - f. That articles and materials and their records clearly indicate their acceptance or nonconformance status when released from receiving inspection and test.
  - g. That articles and materials to be released are adequately controlled and protected for subsequent handling, storage, or use.
- 3.4.7 Receiving Records. Receiving inspection and test records shall be maintained for articles and materials to indicate, as a minimum, date of receipt, accomplishment of applicable requirements of paragraph 3.4.6, results of inspections and tests, inspection and test procedures utilized, and disposition of the articles or materials. Records shall include copies of pertinent supplier documents received, or an indication of the type of documents received and their location.
- 3.4.8 Supplier History System. Receiving inspection and test results shall be recorded to reflect on a continuous basis the qualitative and quantitative performance of individual suppliers and the quality history of the supplied articles and materials.
- 3.4.9 Post-Award Survey of Supplier Operations. Seller shall schedule and conduct post-award surveys of suppliers on the basis of type of articles and materials being procured, known problems or difficulties, procurement source quality history, fabrication and testing capability, and remaining period of supplier performance. Seller shall document survey results, and shall include description of problem areas discovered, recommendations for timely correction and prevention of deficiencies, and recommendations for follow-up action.

- 3.5 Fabrication Controls.
- 3.5.1 Fabrication Operations. Seller shall control fabrication operations, including assembly. Detailed fabrication documents shall be generated and utilized by personnel conducting fabrication operations. Fabrication documents shall be reviewed for inclusion of all applicable quality assurance controls.
- 3.5.2 Article and Material Controls. Seller shall establish controls to ensure that:
- a. Only conforming articles and materials are released and used, and that articles and materials not required for the operation involved are removed from the work operations area.
  - b. Articles identified by Seller, or by Buyer in the procurement specification, as being time-cycle or age-sensitive shall be marked to indicate the date, test time or cycle the critical life was initiated and the date, test time or cycle the useful life will be expended, and that this same information shall be recorded in log books. Recorded data shall be maintained for such articles in accordance with documented requirements.
  - c. Articles and materials to be fabricated or processed in a temperature-controlled environment shall be inspected and tested in a similar environment to the extent necessary to prevent quality degradation.
  - d. Contaminant-sensitive articles and materials fabricated or processed in contamination-controlled environments shall be inspected, tested, repaired, or modified in an environment equal to or cleaner than the required fabrication or process contamination-control environment.
- 3.5.3 Process Controls. Seller shall implement controls for those processes where uniform, high quality cannot be assured by inspection of the articles alone. These processes include, but are not limited to, metallurgical and chemical processes, metal-joining processes, bonding processes, plastics application, plating and coating processes, and surface-treating processes. In addition, Seller shall identify those material processes deemed critical to the fabrication and operation of the article (e.g., finish on O-ring seats, lens coating, glass temper, bearing finish), and shall advise Buyer of any changes to these processes after the design is frozen. Each Seller will have a process listing unique to the particular article fabricated.
- 3.5.3.1 Contaminant-Sensitive Articles. Seller shall clean each contaminant-sensitive contract end-item, and all components, parts, etc., supplied with such end-item which are significant to end-item cleanliness requirements, and shall maintain cleanliness in these articles at the specified levels.
- 3.5.3.2 Contamination Control. Seller shall verify compliance with cleanliness requirements.
- 3.5.3.3 Nondestructive Evaluation. Seller shall utilize and control, as applicable, nondestructive evaluation techniques such as radiography, ultrasonic testing, dye penetrant inspection, magnetic particle inspection, and other applicable methods to ensure hardware of the prescribed quality.
- 3.5.3.4 Process Control Procedures. Seller shall prepare process procedures to implement applicable processing requirements, as defined by material and process specifications, and shall include detailed performance and control provisions therein.

- 3.5.3.5 Equipment Certification. Seller shall provide for the certification of equipment for selected processes and maintain records of such certification.
- 3.5.4 Workmanship Standards. Seller shall select samples or visual aids \_\_\_\_\_ to define acceptable workmanship. (Standards prepared by Buyer are available to Seller and may be obtained from Buyer Quality Assurance department upon request.)
- 3.5.5 Control of Temporary Installation. Seller shall identify control and monitor articles, including shipping and handling protective materials, which are to be installed temporarily and then removed from Seller's end-item.
- a. Temporary articles shall carry distinct identification (e.g., red caps/streamers).
  - b. Temporary installations and removals shall be recorded on a single and separate log for each end-item. This log shall be initiated upon introduction of the first temporary installation or removal, and shall be maintained during subsequent efforts until shipment of the end-item to Buyer and included with shipment.
  - c. Temporary installations to be removed by Buyer at Buyer's facility shall be clearly identified.
- 3.6 Testing, Inspection, and Evaluation.
- 3.6.1 General. Seller shall plan and conduct inspections and tests which demonstrate that contract, drawing, and specification requirements have been met on all articles and materials, procured and produced. These shall provide the assurance and documented objective evidence that the quality inherent in the design is maintained throughout the contract.
- Seller shall maintain an inspection flow that is in consonance with the manufacturing and test flow, and shall identify significant inspection stations.
- 3.6.2 Inspection and Test Planning. Seller shall provide the necessary planning functions for the accomplishment of inspections and tests, and shall provide an adequate documentation system which substantiates accomplishment of these inspections and tests.
- During the earliest practicable phase of performance, Seller shall conduct a complete review of the requirements of the contract to identify and make timely provision for the special controls, processes, test equipment, fixtures, and tooling requirements for assuring or assessing product quality. When production jigs, fixtures, tooling masters, templates, patterns, and such other devices are used for inspection, their accuracy prior to release for use shall be a consideration of Seller's quality and manufacturing planning functions.
- 3.6.3 Test Specifications. Seller shall prepare a test specification for each test to be performed on Seller's end-item(s), and shall review each test specification prior to release to assure compliance with Buyer's requirements as defined through Buyer's procurement document.
- 3.6.4 Inspection and Test Procedures. Seller's inspection and test procedures shall be readily available to inspection and test personnel and shall be physically located at the applicable location at the time of inspection or test.
- 3.6.5 Inspection and Test Performance.

- 3.6.5.1 Inspections and Tests. Seller shall control inspection and test environments and equipments to preclude degradation of the quality of the article being evaluated, and shall ensure appropriate reinspection and retest after completion of any remedial or preventive action necessitated by article deficiencies.
- Seller shall ensure that each inspection and test operation is traceable to the individual who performs the operation, and shall keep comparable traceability for fabrication and assembly operations to the extent practicable.
- 3.6.5.2 Qualification Test Articles. Seller shall verify that manufacturing and inspection records, end-item inspection and test procedures, authorized deviations, nonconformances, approved waivers, removal and installation records, operating-time records, change verification records, safety procedures, emergency shutdown procedures, rework and retest criteria, and procedures for use of special measuring devices are available when qualification test is required by Buyer's procurement specification.
- 3.6.5.3 Regualification Testing. After successful completion of qualification testing, Seller shall monitor engineering, manufacturing, and quality assurance activities to identify and analyze any condition which might require hardware requalification.
- a. Seller shall identify to Buyer any change from the baseline conditions defined at the time of approval of qualification-test hardware. Changes such as relocation of manufacturing facilities, modification of processing operations, fabrication methods or assembly techniques, or use of a different procurement source for material, components or subassemblies, or processing may require hardware requalification.
  - b. Seller shall analyze the effect of changes related to hardware qualification status, evaluate the significance of such changes, and make recommendations to Buyer concerning the need for requalification testing.
- 3.6.5.4 End-Item Inspections and Tests. Seller shall perform inspections and tests of completed end-items intended for delivery under Seller's contract with Buyer.
- a. Nonconformances discovered prior to start of testing, during testing, or after testing, shall be closed out prior to succeeding operations, including shipping, in accordance with paragraph \_\_\_\_\_ (3.7 ? ).
  - b. The inspections and tests shall be performed in accordance with Seller's procedures.
  - c. Seller shall stop testing when safety of personnel is in jeopardy, or when damage to the end-item or associated test equipment is probable.
- 3.6.5.5 End-Item Reinspection and Retest. Seller shall secure pre-implementation approval by Buyer of any adjustments, modifications, repairs, replacements, or rework after completion of end-item inspections and tests for the purpose of Buyer acceptance.
- 3.6.5.6 Pre-Installation Tests. Functional tests shall be performed on components prior to installation into next-higher assembly when any of the following circumstances exist:
- a. No previous acceptance test.
  - b. Acceptability cannot be verified by test of next-higher assembly.

- c. A significant time has elapsed since the last previous test, such that quality acceptability needs to be verified. The significance of the time period shall be determined from the age/life characteristics of the component.
- d. The component, once installed in the next-higher assembly, is difficult to remove and requires significant schedule time to replace.
- e. Failure history of the component indicates the need for pre-installation testing to verify quality acceptability.
- f. The component, once installed in the next-higher assembly, by its failure could damage the next-higher assembly during test.

3.6.6 Inspection and Test Records and Data. Seller shall generate and maintain records and data of inspections and tests performed.

Seller shall maintain and update the equipment record for each subsystem as a means of documenting its continuing history. Each record shall be identifiable to the pertinent equipment, and shall be maintained in chronological order to account for all fabrications, assembly, inspection, and test operations, as well as idle periods (storage) and movements of equipment. Entries shall be complete, self-explanatory, and traceable to the individual and organization making the entry.

3.6.7 Seller Quality Assurance Actions:

- a. Prior to testing, Seller shall:
  - (1) Verify that applicable inspection and test documents are available and approved.
  - (2) Ensure that requirements for selection and control of articles have been implemented and that test constraints, including environmental considerations, have been resolved.
  - (3) Verify that all test equipment is within calibration requirements and that all personnel certifications (where certifications are required) are valid.
  - (4) Notify Buyer's designated quality assurance representative not less than 48 hours prior to start of test, when required.
  - (5) Notify the designated Government quality assurance representative, when required.
  - (6) Verify that test facility requirements have been implemented and that the facility and supporting test equipment are in the correct configuration and ready for test.
  - (7) Verify the configuration and that the article is ready for test, and concur in the start of testing.
- b. During testing, Seller shall:
  - (1) Ensure that testing is accomplished in accordance with test specifications and procedures.

- (2) Ensure complete and accurate recording of data and test results.
- (3) Record rework, repair or modification occurring during the test operation.
- (4) Document nonconformances and their dispositions.

c. Subsequent to testing, Seller shall:

- (1) Ensure proper disposition of articles.
- (2) Report any additional nonconformances and their dispositions.
- (3) Ensure that remedial and preventive action has been accomplished relative to nonconformances.
- (4) Verify that test results and reports are accurate, complete, and traceable to the tested articles.

3.6.8 Pre-Closeout Inspection. Seller's quality organization shall prepare for and conduct pre-closeout inspections on contract end-items at predetermined points in the fabrication and assembly cycle.

3.6.9 Quality Assurance Designees. Seller may designate certain trained and qualified manufacturing and test personnel to represent the quality assurance organization in performance of selected inspection functions to the extent that it is economically advantageous. The quality control functions of the designees shall be performed as part of their regular manufacturing and/or test function. This technique shall include the identification of hardware, fabrication processes, manufacturing flow, and inspection points. The selected inspection and test functions shall exclude those processes, inspections, and tests which are considered critical or cases where inspection cannot be readily accomplished due to further assembly or installation of the hardware.

3.7 Nonconforming Articles and Materials.

3.7.1 Nonconforming Article and Material Control. When an article or material, produced or procured by Seller or by Seller's supplier prior to Buyer acceptance, does not conform to applicable drawings, specifications or other requirements, the article or material shall be identified as nonconforming, segregated to the extent practicable, and held for review action.

- a. Articles and materials which have received Buyer and/or Government acceptance shall be subject to the requirements of Section 3.12, Government Property Control.
- b. Seller shall provide for the identification, documentation, and control of nonconforming deliverable hardware.
- c. Seller shall provide a means for Seller's quality assurance activity to overstamp a nonconformance marking to indicate subsequent determination of article acceptability. This overstamp will indicate that the nonconforming hardware is acceptable.
- d. Hardware procured by Seller for direct shipment from a supplier to Buyer, or to NASA, shall be shipped with an open nonconformance only with prior approval by Buyer, and with prior approval by NASA when shipment is to NASA.

3.7.2 Nonconformance Reporting and Correction. Seller shall:

- a. Establish a controlled, closed-loop documentation technique for recording, reporting, analyzing, correcting, verifying, and feeding back data on nonconformances (discrepancies) discovered by Seller, supplier, Buyer, and/or NASA.
- b. Maintain records of discrepancies and their dispositions.
  - (1) All records of Seller's nonconformance reporting and correction will be maintained and made available to Buyer for review.
  - (2) The documents prepared and issued for each discrepancy will contain, as a minimum:
    - (a) A unique and traceable number;
    - (b) The nomenclature and identification of the nonconforming article or material;
    - (c) A description of the required characteristic or design criteria and the nonconformance;
    - (d) Cause or reason for the nonconformance;
    - (e) Preventive and/or corrective actions taken or recommended;
    - (f) Disposition (remedial action) of the nonconforming article or material;
    - (g) Initiator of the document;
    - (h) Signatures of authorized personnel;
    - (i) Date that the nonconformance occurred;
    - (j) Type of activity being conducted; e.g., fabrication, assembly, qualification test, systems test, pre-delivery of pre-installation acceptance test, etc.; with reference to applicable procedure numbers;
    - (k) Area, function, or activity responsible for causing the failure or discrepancy;
    - (l) Classification of the nonconformance (Buyer action required/not required; NASA action required/non required);
    - (m) Reference to documented repair procedures, as applicable.
- c. Tabulate nonconformances in summary and trend reports.
- d. Commence nonconformances recording upon initiation of manufacturing for development and flight hardware, launch complex, and related support equipment, and continue through all subsequent phases of the contract.
- e. Conduct appropriate analysis and examination of nonconforming articles, materials, or conditions to determine the cause or reason for the nonconformance. Nonconforming articles or materials may be forwarded to Buyer as requested by Buyer.
- f. Conduct timely and effective remedial action to ensure the correction of the article or material.

- g. Conduct timely and effective preventive action to prevent recurrence of the nonconformance, including correction of technical documents, correction of other identical articles or materials at all locations under Seller control and the prevention of detrimental side effects.
- h. Initially review nonconforming articles and materials and determine one of the following dispositions. Seller shall request Buyer approval for each proposed use of articles or materials which do not conform to Buyer's procurement specification, and shall withhold the nonconforming articles or materials from further processing until Buyer approval is provided or another course of action is indicated.

- (1) Return for Rework or Completion of Operations. If the nonconformance is in the category of "return for completion of operations" or "return for rework to drawings, specifications or procedures," the article or material shall be returned for rework or completion using established technical documents and operations. During such rework, the article or material shall be resubmitted to normal inspection and/or test operations.
- (2) Scrap. If the article or material is unfit for use, it shall be dispositioned in accordance with Buyer-approved Seller procedures for identifying, controlling, and disposing of scrap.

Seller shall assure that scrap is accounted for as to its end use, and that it is not to be used for deliverable hardware.

- (3) Return to Supplier. When an article or material is found to be nonconforming on receipt, it should be returned to the supplier. Seller shall provide the supplier with nonconformance information, and assistance as necessary, to permit remedial and preventive action.
- (4) Submit to Material Review Board. When the dispositions as described above are not appropriate, the article or material shall be submitted to the MRB for final disposition in accordance with the provisions of paragraph 3.7.3. When Buyer MRB action is required for a physical nonconformance, Seller shall complete Buyer Form L 23-H-1, attach all required drawings, test results, and other essential data, and submit to Buyer.
- (5) Waiver. Seller requests for waivers may be submitted to Buyer for approval prior to or as a result of consideration of other dispositions. Each waiver request, based on a lack of conformance to requirements of Buyer's procurement specification related to function of Seller's end-item, shall be accompanied by Seller's proposed plan for preventive action, and all applicable drawings, test results and other essential data.

- i. Articles and materials disposed of without referral to the MRB shall be subject to a review of each case by Buyer to verify appropriateness of Seller's decisions.

3.7.3 Material Review Board. All Material Review Board (MRB) authority is reserved by Buyer, except that Buyer may delegate MRB authority to Seller upon request, in which instance only shall the following apply:

- a. Membership. Seller's MRB shall be comprised of at least one Seller representative whose primary responsibility is engineering, one Seller representative whose primary responsibility is product quality, a Buyer representative, and/or a designated NASA representative.

- (1) Seller members for the MRB shall be selected by Seller on the basis of technical competence and shall have sufficient authority to make appropriate dispositions of the article or material involved. Buyer approval may be required for appointment of Seller members of Seller's MRB.
  - (2) When critical functions of the article or material involved are not affected by a nonconformance, Seller's MRB may function without the Buyer and/or NASA representative with prior approval by Buyer and/or NASA.
  - (3) Seller MRB actions on non-critical nonconformances shall be submitted to Buyer and/or NASA in accordance with the applicable data requirements document.
- b. Responsibility. The Seller's MRB review shall determine or recommend disposition, such as scrap, repair, etc., or exercise the option of recommending dispositions to Buyer, approve the method and procedure for repair, when repair is appropriate, provide Seller recommendations to Buyer concerning nonconformance dispositions requiring Buyer and/or NASA contracting officer approval, and verify implementation after approval is obtained, ensure that effective remedial and preventive actions are documented on the nonconformance document, and ensure that accurate records of MRB actions are maintained.
- c. MRB Dispositions. Dispositions other than "scrap" require the unanimous agreement of the applicable Board members. In determining dispositions, the Board shall: consider the effect of the nonconformance upon the intended use; classify nonconformances as to criticality and process on a priority basis; review records of earlier review actions affecting the same or like article or material; and consider the recommendations of personnel acting in an advisory capacity. The Board shall specify on the nonconformance document one of the following dispositions:
- (1) Repair. When an acceptable repair is possible, in the opinion of the Board, repair action may be authorized. Provision shall be made for manufacturing repair procedures including detailed requirements, inspections and tests, and maintenance of records.
  - (2) Repair per Standard Repair Procedure. Seller may use standard repair procedures, after approval by Buyer's MRB. Standard repair procedures shall identify limitations to hardware applicability, extent of characteristic nonconformance, detailed instruction for accomplishing the repair, and inspection/test criteria for the repaired article or material.
  - (3) Use-As-Is. A nonconformance which the MRB determines to be suitable for use without repair may be given a use-as-is disposition. The rationale for making this disposition shall be documented on the nonconformance report.
  - (4) Scrap. Refer to paragraph 3.7.2 h(2) for description.
- d. MRB Holding Area. Seller shall establish holding areas for articles and materials submitted to the MRB. These holding areas shall provide for the following:
- (1) Access limited to MRB members, personnel escorted by an MRB member, and quality personnel administering the area. Seller shall make provisions to prevent unauthorized entrance when area is not attended, and to preclude

removal of hardware except in accordance with the approved MRB disposition.

- (2) Storage facility.
- (3) Log book for recording location and status of articles and materials.
- (4) Posting of the current list of the names of authorized personnel, including MRB members.

e. Supplier Material Review Board:

- (1) Seller, upon determining that a supplier possesses the capability to meet MRB requirements to the extent approved to Seller by Buyer, may delegate MRB responsibility to the supplier. Seller must obtain prior approval by Buyer and/or NASA representative(s).
- (2) Seller will limit the authority of the supplier's MRB dispositions to nonconformances not requiring waiver action.
- (3) Nonconformances requiring waiver action shall be processed in accordance with the applicable contract provisions.

f. Document Transmittal. Seller shall include applicable MRB documents for Repair, Standard Repair, and Use-As-Is dispositions in the data package delivered with the hardware as specified in Buyer's data requirements document.

3.8 Metrology.

3.8.1 Metrology Controls. Seller shall establish and utilize a documented metrology activity to control measurement equipment accuracy in order to provide objective evidence of quality conformance.

3.8.2 Acceptance:

- a. Prior to use for acceptance of articles and materials, Seller shall ensure that all measurement standards and equipment are inspected and/or tested to ensure conformance with requirements.
- b. Documented results of the inspection and/or tests shall be maintained by Seller.

3.8.3 Evaluation. All special measurement standards and equipment (e.g., automatic test and checkout equipment) shall be evaluated under intended operating conditions to verify that:

- a. When used in the intended measurement process, the standards and equipment measure the desired characteristics to the required accuracy and provide the desired indications or records.
- b. Standards and equipment are compatible with the configuration of related hardware and environmental conditions.
- c. Operating instructions are correct and complete.
- d. Documented results of the evaluations shall be maintained by Seller.

- 3.8.4 Article or Material Measurement Processes. Random and systematic errors in any article or material measurement process shall not exceed ten percent of the tolerance of the article or material characteristic being measured. Exception to this requirement or purchase of additional equipment to meet this requirement shall require approval by Buyer.
- 3.8.5 Calibration Measurement Processes. Random and systematic errors in any calibration measurement process shall not exceed twenty-five percent of the tolerance of the parameter being measured. Exception to this requirement or purchase of additional equipment to meet this requirement shall require approval by Buyer.
- 3.8.6 Calibration Controls.
- 3.8.6.1 Traceability. All measurement standards shall be traceable to standards maintained by the National Bureau of Standards, or their value(s) shall be derived from a controlled measurement process utilizing a fundamental constant of nature.
- 3.8.6.2 Handling, Storage, and Transportation. All measurement standards and equipment shall be handled, stored, and transported in a manner which will not adversely affect quality or result in hazardous conditions.
- 3.8.6.3 Identification and Labeling. All measurement standards and equipment shall be uniquely identified and labeled, tagged, or coded to indicate calibration status and due date of next calibration.
- 3.8.6.4 Calibration Intervals. Calibration intervals shall be established and periodically reviewed to maximize the availability of measurement standards and equipment without adversely affecting quality.
- 3.8.6.5 Recall Systems.
- a. All standards and equipment used in measurement processes shall be recalled and recalibrated at established intervals.
  - b. Measurement standards and equipment not recalibrated before the recall due date shall be removed from service or otherwise restricted from use until recalibration is accomplished. Authorization for exception shall be obtained from Buyer.
  - c. Any measurement standard or equipment which is damaged, which affects quality adversely, or which is suspected of affecting quality adversely, shall be removed from use until repair and/or recalibration is accomplished.
- 3.8.6.6 Calibration Records. Seller shall maintain individual records of measurement standards and equipment.
- 3.8.7 Environmental Requirements. Environmental characteristics (e.g., temperature, humidity, vibration, cleanliness) shall be compatible with the accuracy requirements of the article and material and calibration measurement processes.
- 3.8.8 Remedial and Preventive Action. Remedial and preventive action shall be taken relative to nonconforming measurement standards or equipment and shall extend to the article or material measured when such equipment has been used in final acceptance of the article or material.

3.9 Stamp Controls.

3.9.1 Stamp Control. Seller shall establish and maintain a documented stamp control technique, including written procedures, that provides for the following:

- a. Stamps, decals, seals, torque wax, paints, signatures, etc., shall identify that articles and materials have undergone source and receiving inspection, in-process fabrication and inspection, end-item fabrication and inspection, end-item testing, storage, and shipment.
- b. Stamps shall be traceable to individuals responsible for their use, and records shall be maintained to identify individuals with specific stamps.
  - (1) Unissued stamps shall be kept secure to prevent unauthorized use.
  - (2) Stamps issued to personnel being transferred or terminated shall be returned and shall not be reissued for a suitable period of time.
  - (3) Worn or damaged stamps shall be destroyed at the time replacement stamps are issued.
  - (4) The identification (number, letter, etc.) symbol of lost stamps shall be withdrawn from use for a suitable period of time.
  - (5) The use of any stamp by an individual other than the holder of record is specifically prohibited.
  - (6) Stamp audits shall be conducted periodically to verify that stamps are in the possession of the individuals to whom they are issued.
- c. Stamps shall be applied to records to indicate the fabrication or inspection status of associated articles and materials.
- d. Stamps shall be applied to tags, cards, or labels attached to individual articles and materials or their containers, as appropriate.
- e. Stamps indicating that fabrication, inspection, or test operations have been performed may be applied directly to articles and materials except when this is impractical due to physical limitations of the article or when such applications will compromise article quality.
- f. Stamping methods and marked materials must be compatible with the articles and their use.
- g. Seller shall maintain an up-to-date description and explanation of the significance of all stamps and shall have, as a minimum, a unique identification or mark for acceptance, for holding a nonconformance pending MRB disposition, for rejection, for MRB approval, and for special process or nondestructive evaluation and/or inspection acceptances.

3.9.2 Stamp Restriction.

- a. The designs of Seller's stamps shall be such that fabrication and inspection stamps are distinctly different.

- b. Seller's stamps shall be clearly distinguishable from Buyer stamps.
- c. Seller's stamps shall not exhibit the designation "NASA" or abbreviations of any NASA installation.

3.10 Handling, Storage, Preservation, Marking, Labeling, Packaging, Packing, and Shipping.

3.10.1 Procedures and Instructions Control. Seller shall review for concurrence, prior to release, those procedures and instructions which describe in detail the controls for handling, storage, preservation, marking, labeling, packaging, packing, and shipping operations. Effective implementation of these documents shall be assured through controls administered by Seller's quality activity.

3.10.2 Handling.

- a. Seller's quality activity shall verify that manufacturing planning documents (routing sheets, operations sheets, travelers, etc.) contain handling instructions and the identification of any special handling equipment used to prevent handling damage.
- b. Hardware that may be susceptible to damage shall be provided with special covers, containers, boxes, carts, or vehicles to prevent damage during fabrication and processing.
- c. All installations, test, and operational sites shall be provided copies of handling instructions to prevent handling damage.
- d. Evidence of initial and periodic proof-testing of applicable handling equipment shall be maintained.

3.10.3 Storage. Controls on storage areas for articles and materials not in work shall include controlled acceptance into and withdrawal from the storage area; positive identification of limited-life material and removal of materials whose shelf life has expired; periodic inspection of material stores, housekeeping, and record keeping; and systematic inspection and/or testing necessary to insure maintenance of preservation, including special environments, for articles in long-term storage.

3.10.4 Preservation.

- a. Seller shall ensure that articles and materials subject to deterioration, corrosion or contamination through exposure to air, moisture, or other environmental elements during storage and fabrication are cleaned and preserved by methods which ensure maximum protection consistent with life and usage.
- b. Seller shall verify that preservation instructions, including material and process definition, are contained in Seller's manufacturing documents and are accomplished.

3.10.5 Packaging. Seller shall verify that packaging material, procedures, and instructions are utilized and provide for protection of articles and materials while at Seller's plant, during transportation to destination, and after arrival at destination.

- a. Seller may utilize existing specifications (industrial or Government) or develop and document special specifications to ensure maximum protection.

- b. Special attention shall be directed toward critical, sensitive, dangerous or high value articles.
- c. Seller shall ensure that packaging operations are specified in the manufacturing documents, that sufficient detail is included to ensure the integrity of the packaging and the hardware, that specific internal environments necessary to prevent degradation or contamination of the article or material are included in the packaging.
- d. Seller shall verify the accomplishment of packaging operations.

3.10.6 Packing.

- a. Seller shall perform inspection operations, as necessary, to ensure that articles or materials are ready for packing, are not damaged during packing operations, and that packing meets the specified requirements.
- b. When reusable containers are to be used, they shall be inspected prior to each use to ensure completeness and suitability.
- c. Seller shall provide detailed unpacking and handling instructions for delivery with hardware which can be damaged if special unpacking instructions are not followed, and shall clearly identify containers which have special unpacking and handling requirements.

3.10.7 Marking and Labeling. Seller shall ensure that appropriate marking and labeling for packaging, storage, and shipping of articles and materials is performed in accordance with applicable specifications.

- a. The marking shall include such information as complete article or material identification, cleanliness level, environmental requirements, package orientation arrows, unpacking requirements, caution and warning notes, life expiration dates, location of data package, and transportation information, as applicable.
- b. Tamper-proof decals or labels shall be utilized on precision-cleaned articles to permit ready detection of loss in packaging integrity.

3.10.8 Shipping. Seller shall implement controls for articles and materials to be shipped from Seller's plant and shall notify Buyer in the event of any unscheduled removal of an article or material from its container. The extent of reinspection and retest shall be as authorized by Buyer. The location of the data package shall be indicated on the exterior of the shipping container.

3.11 Sampling Plans, Statistical Planning and Analysis.

3.11.1 Sampling Plans. Seller may use sampling plans when inspections or tests are destructive, or when data, inherent characteristics, or the noncritical application of an article or material indicates that a reduction in inspection or testing can be achieved without jeopardizing achievement of quality, reliability, or design intent.

- a. When sampling techniques are to be employed, existing military sample inspection documents shall be utilized to the degree practicable.
- b. Sampling plans other than those contained in existing military documents may be utilized by Seller after approval by Buyer.

- 3.11.2 Statistical Analysis. Seller may use statistical analysis techniques where such use will provide effective control over fabrication and inspection operations especially in those areas where special processes and equipment are difficult to control. Statistical charts shall be maintained at a location that will provide maximum preventive action utilization.
- 3.12 Government Property Control. Seller shall assure that the requirements of Appendix B of the NASA Procurement Regulation are fully satisfied with regard to Government property control.

## **GLOSSARY**

The following definitions apply to terms as used in this specification:

ACCEPTANCE - The act of an authorized agent of the procuring organization by which the procuring organization assents to ownership of existing and identified contract items, or approves specific services rendered as partial or complete performance of a contract.

ACCEPTANCE TESTING - Tests to determine that a material, part, component, subsystem, or system is capable of meeting performance requirements prescribed in the procurement specification or other documents specifying what constitutes acceptable performance capability for the item in question.

CORRECTIVE ACTION - Action taken to preclude occurrence of an identified hazard or to prevent recurrence of a problem. The terms "corrective action" and "preventive action" are synonymous in this specification.

DEFECT - A condition of any hardware in which one or more characteristics do not conform to the specified requirements.

DEVIATION - A specific authorization, granted before the fact (see WAIVER for after-the-fact authorization), to depart from a particular requirement of Buyer specifications or related documents.

LIMITED-LIFE - A designation referring to limited useful life regardless of whether the limitation is due to operational consideration, shelf life, or a combination of these.

LIMITED-LIFE ITEM - Any item designated as having a limited useful life regardless of whether it is a limited operating life, limited shelf life, operating life sensitive, or combination of these. This includes, where appropriate, fluids, elastomers, and polymers.

LIMITED-OPERATING-LIFE ITEM - Any item which deteriorates with increased accumulation of operating time/cycles and this requires periodic replacement or refurbishment to assure that its operating characteristics have not degraded beyond acceptable limits including consideration for total mission time/cycles and safety factor margins.

LIMITED-SHELF-LIFE ITEM - Any item which deteriorates with the passage of time and thus requires periodic replacement, refurbishment, retesting, or \_\_\_\_\_ to assure that its operating characteristics have not degraded beyond \_\_\_\_\_ limits. This includes installed as well as stored components.

MATERIAL PROCESS - That action which results in a change to the physical or chemical properties or form of materials and parts.

NONCONFORMANCE - A condition of any article or material or service in which one or more characteristics do not conform to requirements. Includes failures, discrepancies, defects, and malfunctions.

OPERATING CYCLES - The cumulative number of times an item completes a sequence of activation and return to its initial state; e.g., a switch-on/switch-off sequence, a valve-opened/value-closed sequence, tank pressurized/depressurized, or dewar cryogenic exposure/drain.

OPERATING LIFE - The maximum operating time/cycles which an item can accrue before replacement or refurbishment without risk of degradation of performance beyond acceptable limits.

PROCUREMENT DOCUMENTS - Documents such as telegrams, letter contracts, purchase orders, and change notices used to transmit requirements for productive-use hardware, software, or support services to procurement sources.

QUALIFICATION TEST - A test structured to certify that design requirements have been met.

REMEDIAL ACTION - Action to correct a nonconforming article or material.

TECHNICAL DOCUMENTS - Documents such as drawings, specifications, and checkout procedures which relate to operating characteristics, performance, size, shape, fit, etc., of a product and/or related fabrication, assembly, processing, testing, inspection, handling, and control operations.

WAIVER - Granted use of acceptance of an article which does not meet specified requirements. A waiver is given or authorized after the fact.

This amendment forms a part of Specification MT0802-101, Revision C, dated August 27, 1973. Add paragraph 3.13 to read as follows:

- 3.13        Test Hardware Reuse Control. Seller shall implement controls for segregation and accountability of engineering test items to preclude their refurbishment and/or reuse as production items without the express authorization by the Buyer. In addition, a record of Buyer authorization for refurbishment and a record of completion of the refurbishment shall be provided in the Acceptance Data Package (ADP) for any Seller-End-Item (SEI) which is a refurbished test item or which contains a component which is a refurbished test item.

DIRECT CHANGES INCORPORATED AND RELEASED AT "C" REVISION.

The changes incorporated in the "C" revision result from a major effort to simplify the specification through the elimination of redundant requirements and detailed procedures.